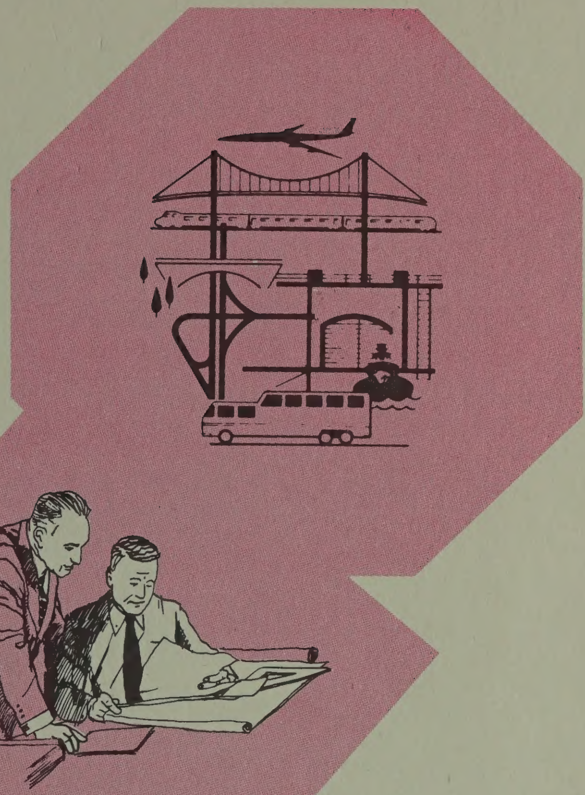
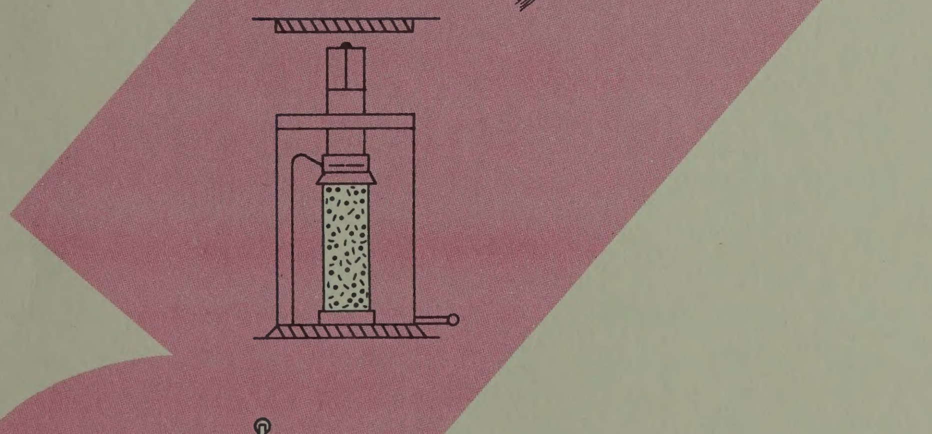
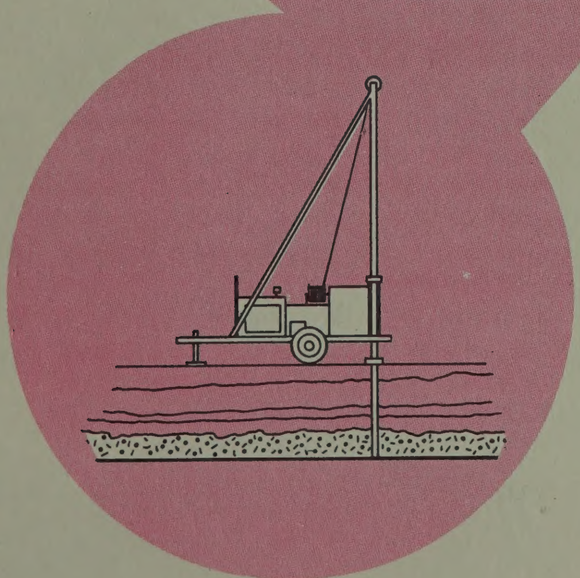
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION

# SOIL MECHANICS BUREAU







# EXPERIMENTAL INSTALLATION OF ELJEN DRAINS FOR PAVEMENT SUBDRAINAGE

INTERSTATE ROUTE 88
SCHENECTADY COUNTY

JANUARY 1981

SM 238b (1/73)

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## INTRODUCTION

Early in 1979, representatives from Eljen Drain Company of Storrs, Connecticut and A. H. Harris & Sons, local materials' supplier, demonstrated a new version of the Eljen drain. This fin type drain assembly was developed by Professors Ken Healey and Richard Long of the University of Connecticut in the 1960's. The drain consists of an underdrain and a vertical fin all wrapped in filter fabric. The principal application is for a trench installation to intercept sidehill drainage. The principal advantage of this system is the elimination of underdrain filter material. The improved version consists of a corrugated slotted plastic pipe underdrain, a studded plastic core to serve as a fin and a filter fabric for an envelope.

It was suggested that there may be a potential application for this type of drain in edge of pavement subdrainage installations. It was decided to install a trial installation on an Interstate construction contract 20 miles west of Albany, New York (I-88, Schenectady County Line to Schoharie Turnpike, Contract No. D95722). The contract required 47,000 feet of edge drain installation including a crushed stone backfill material.

## FIELD INSTALLATION

In the fall of 1979, a 100 foot long test section was constructed. It was designed for all collected water to drain to one outlet for observation purposes. The pavement on this contract consisted of 9 inches of unreinforced Portland cement concrete on a 12 inch thick gravel subbase. Transverse joint spacing was 20 feet with load transfer by dowels.

As part of the experiment, it was decided to place horizontal strips of drainage fins under each transfer joint assembly to collect and drain water entering through the transverse joint. Each strip was placed on the subbase

prior to installation of the joint assembly for the full width. See Figure 1. It was decided that future installations could be facilitated by placing the assembly first and laying a narrower strip under the assembly. A one inch diameter hole was drilled through the transverse joint for future permeability tests.

Figure 1. Installation of Eljen drain under transverse joint assembly for load transfer dowels.

A trenching machine excavated a trench at the edge of pavement 14 inches wide and 21 inches deep. The fin and underdrain pipe were assembled on the adjacent pavement in 20 foot sections and lowered into the trench. The excavated subbase gravel was used as backfill and was compacted in two lifts by a hand operated vibratory plate compactor with a 13 inch wide base. The drainage fin was pushed against the pavement side of the trench and the backfill could be compacted without tearing the fabric provided that the operation was done with care. The horizontal fin drains at the transverse joints were exposed in the trench excavation and were in contact with the vertical fin. The subbase gravel

used as backfill contained up to 10 percent -200 sieve size material and has a relatively low permeability when compacted. See Figures 2, 3, and 4.

Figure 2. Preparation of Eljen drain for installation.

Figure 3. Installation of Eljen drain in trench at edge of pavement.

Figure 4. Trench backfill operation using excavated subbase gravel. Note standard crushed stone backfill in background.

PERFORMANCE

The asphaltic concrete shoulders were placed over the installation in mid-1980. The Project Engineer has inspected the outlet after rains and has not observed any flow at the outlet. On the standard drains with crushed stone backfill (1/2 inch size) considerable outlet flows (1 inch depth in 6 inch outlet pipe) have been observed after rain. The length of underdrain in these sections is approximately 600 feet as compared with the 100 feet on the test section.

An attempt was made to determine if there was drainage through the transverse joint installations. The drilled hole in the concrete was cleaned out and a drop of 4 inches of water was observed in four hours. The next step was to place a 1 inch plastic pipe over the hole to find out if drainage occurred under a head. A 3 to 4 foot head of water was applied and there was some loss

of water because of a poor seal at the pavement surface. The plastic stand pipe was filled approximately ten times over a 90 minute period and no water was observed at the outlet. The only conclusion from this testing was that some water was taken into the pavement section.

## LABORATORY TESTING

A laboratory model was constructed to determine if the flow rate through the fin drain decreased under surcharge loading. There was concern that the fabric would squeeze into the stud conformation reducing the permeability of the drain. A watertight box 9 inches by 7 inches by 3 feet in height was constructed with an outflow below the horizontal fin drain installation near the bottom. The box was backfilled with compacted pervious sand. Water flowed through the system readily in backfill thicknesses varying from 12 to 30 inches. There was no significant flow change under varying backfill thicknesses. When the head of water was increased from 12 to 30 inches there was some increase in flow. See Figures 5 and 6.

Another series of tests were conducted to simulate the condition of placing concrete directly on the fin drain surface. Stand pipes were installed through the concrete to allow water to reach the top surface of the plastic drain. However, there was no drainage in the system indicating that the concrete sealed the top surface of the drain. In another series of tests, 2 inches of sand was placed on the fin drain before placing the concrete and the drain performed satisfactorily.

Figure 5. Laboratory permeability test apparatus.

Figure 6. Apparatus designed to monitor flow through Eljen drain. Edge section exposed.

## CONCLUSIONS

1. Transverse Joint Drainage - Laboratory tests indicated that when concrete is placed and vibrated in contact with the fin drain the top surface of the drain is sealed and the drain will not function. The field permeability test indicated that some water entered the pavement system at a very slow rate but no outflow was observed.
2. Edge of Pavement Drain - There has been no observed flow of drainage from the edge of pavement drain in the test section to date. This is in contrast to the rest of the edge of pavement drainage where underdrain filter material was used to conduct water to the underdrain pipe and outflow was observed after rainstorms.

## DISCUSSION

The purpose of this experimental installation was to seek a more economical design for edge of pavement underdrain. The major cost of this type of underdrain is the backfill filter material. For example, on this project the bid prices for 47,000 lineal feet of underdrain was as follows:

| | | |
|---|---|---|
| Excavation - - - - - - - - - - - - - | $ .70/l.f. | 20% |
| Underdrain pipe - - - - - - - - - - | $ .60/l.f. | 17% |
| Underdrain filter - - - - - - - - - | $2.16/l.f. | 63% |
| | $3.46/l.f. | 100% |

There were no positive indications that this experimental installation was effective. However, it is recommended that industry continue to develop new improved pavement subdrainage systems. The potential for eliminating costly underdrain filter material should make alternate methods competitive.

It is our opinion that the edge of pavement subdrain is more important than the transverse joint drain since research has indicated that most of the water entering the pavement section is at the longitudinal edge joint.

ACKNOWLEDGEMENTS

This experiment was made possible through the cooperation of the following people. Joseph Glasser, Director of Sales, Eljen Development Corporation; Charles E. Eck, President, A. H. Harris & Sons Inc.,; Jeffrey Rorg, Project Engineer, Lane Construction Company, Meriden, Connecticut; and Loyal Towers, Project Engineer, New York State Department of Transportation.

This report was prepared by the following members of the Soil Mechanics Bureau - Edward C. Sees, Frederick J. Gorczyca, and Lyndon H. Moore.